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EDITORIAL.

THE Lake Superior excursion, under the leadership of Professors Van Hise and Wadsworth, which preceded the scientific meetings at Madison and Chicago, was participated in by a goodly company of foreign and American geologists from whose testimony we learn that it was unusually profitable and enjoyable. It was thoroughly planned, even to minor details, and carried into execution with remarkable precision, no time being wasted by errors or by undue attention to trivial features. Brief lucid explanations by the guides brought out the essential features of the formations and greatly facilitated observation.

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THE meeting of the Geological Society of America at Madison was attended by somewhat larger numbers than usually gather at a summer meeting. The following twenty papers were offered and read in full or given in substance, with the exception of two, whose authors were absent, and which were only read by title for lack of time: On the Study of Fossil Plants, by Sir J. Wm. Dawson; On a New Species of *Dinichthys*, On a new *Cladodus* from the Cleveland Shale, and On a Remarkable Fossil Jaw from the Cleveland Shale, by E. W. Claypole; Origin of Pennsylvania Anthracite, by J. J. Stevenson; The Magnesian Series of the North-western States, by C. W. Hall and F. W. Sardeson; On the Succession in the Marquette Iron District of Michigan, by C. R. Van Hise; Extra-morainic Drift in New Jersey, by G. Frederick Wright; On the Limits of the Glaciated Area in New Jersey, by A. A. Wright; South Mountain Glaciation, by Edward H. Williams, Jr.; Terrestrial Subsidence South-east of the American Continent, by J. W. Spencer; Evidences of the Derivation of Kames, Eskers, and Moraines of the North American Ice-sheet, chiefly from its Englacial Drift, and The Succession of Pleistocene Formations in the Mississippi and Nelson River Basins, by Warren Upham; The Cenozoic History of Eastern Vir-

ginia and Maryland, by N. H. Darton; Notes on the Geological Exhibits of the World's Fair, by G. H. Williams; Dislocation of the Strata of the Lead and Zinc Region of Wisconsin and their Relation to the Mineral Deposits, with some observations upon the Origin of the Ores, by W. P. Blake; Geology of the Sandhill Region in the Carolinas, by J. A. Holmes; The Gravels of the Glacier Bay in Alaska, by H. F. Reid; The Arkansas Coal Measures in their Relation to the Pacific Carboniferous Province, by James Perrin Smith; Glaciation of the White Mountains, N. H., by C. H. Hitchcock.

Professor Reid's paper on the Gravels of Glacier Bay was given the form of an illustrated evening lecture, and was found entertaining and instructive by the popular audience as well as the members of the society. By admirable photographic illustrations he brought forth very clearly and impressively many of the features of glacial action. It was peculiarly valuable as illustrating the behavior of alpine glaciers when they reach unusual magnitude, and particularly when they approach the Piedmont type.

The paper of Sir J. Wm. Dawson does not admit of ready synopsis. It needs to be read in full. Professor Claypole presented a number of interesting and apparently important facts relative to fossil fishes from north-eastern Ohio.

One of the more notable papers was that of Professor Stevenson, in which objections were urged against the current doctrine of the origin of anthracite through metamorphic agencies connected with heat and pressure. In lieu of this hypothesis, which the author held to be untenable, an hypothesis was offered connecting the origin of anthracite with the conditions of deposition. Anything less than a full statement of the author's view in his own language would fail to do it justice.

The paper of Professor Hall and Mr. Sardeson, read by the latter, endeavored to correlate, in much detail, the series of magnesian limestones of the north-western states. The most notable feature was the placing of the dividing horizon between the middle and the upper Cambrian considerably higher than has been done by most previous writers, throwing the larger part of the

light-colored sandstones that lie below the alternating series into the middle rather than the upper division.

Professor Van Hise gave a lucid sketch of the succession of deposits in the Marquette district and the grounds on which his interpretation is based. The paper showed the steady progress that is being made in the disentanglement of the gnarled structure of that region.

The papers of the Professors Wright awakened special interest from their relation to previously controverted ground. Contrary to their recent contention, they now extend the glaciated area so as to include the localities of High Bridge and Pattenburg and a considerable territory in the Triassic region essentially as maintained by Professor Salisbury before the Professors Wright took up the special study of the matter, though this was not as distinctly acknowledged as might have been desired. The discussion on the part of Chamberlin and McGee took the congratulatory form in view of the removal of one important point of difference and the advance toward harmonious views. It was noted that the points of difference were essentially reduced to two: The correlation of the Trenton gravels and the age of the extra-morainic drift relative to the moraine. In regard to this last it was pointed out that an important contribution had been made, unwittingly perhaps, to the presumption of great difference in the ages of the two drifts, in the fact that the outer drift, especially at such localities as High Bridge and Pattenburg, where it is thick, could not be presumed to be of the same age and character as that of the moraine and moraine-bordered drift, or its glacial origin would not have been previously denied by the Messrs. Wright, and that its age must be presumed to be very much greater or it could not have been referred to a residuary origin, especially to residuary derivation from formations which have disappeared from the neighborhood, since the moraine and moraine-bordered till are very distinctly characterized glacial formations of fresh aspect, while residuary accumulations and residuary topography are inherently expressions of age.

Dr. Spencer submitted a large mass of valuable data relative

to submerged channels in the south-eastern part of the continent, particularly the Antillean region, and urged these as evidences of very great subsidence. The paper awakened considerable discussion, the general tenor of which was the acceptance of the evidence and of the inference of subsidence, with an expression of doubt as to the time of its occurrence and its relations to other geological events.

The paper of Mr. Upham was a fuller statement of the arguments he has recently advanced in support of the derivation of kames, eskers, and moraines chiefly from englacial drift. These, and his views of the internal movement of the ice upon which they are in some degree founded, were opposed by Reid on physical grounds and by others on observational grounds. It was remarked that existing glaciers fail to show basally-rubbed material on their surfaces, even on their low terminal slopes, at least as a common fact. In his second paper, Mr. Upham urged a somewhat simple and brief succession of Pleistocene formations. The successive lines of moraines and the observed overlaps of till were interpreted as signifying minor and relatively brief halts and readvances of the ice. In the discussion, this position was opposed as being inconsonant with the evidences of interglacial intervals and of intervening erosions, oxidations and other changes which the formations were thought to present.

The papers of Darton and Holmes on different but analogous portions of the coastal region showed the very great advances which have been made in the last few years in the analysis and differentiation of the coastal formations, and the interesting discussions they called forth showed, in some measure, the important bearing these have upon the interpretation of the Pleistocene and immediately Pre-Pleistocene histories of the glaciated region.

Professor W. P. Blake, while coinciding in general in the views held by Whitney and by Chamberlin respecting lead and zinc deposits, urged the existence of a greater amount of dislocation than they had recognized, and attributed to it greater influence in the localization of the deposits. His views are intermediate

between those of the authors mentioned and those recently advanced by Mr. Jenney.

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THE attendance upon the meeting of the American Association was less than usual, but the interest and the character of the papers compared favorably with those of other sessions. The provisions made by the local committee were excellent, and the hospitalities extended by the citizens of Madison were graceful and generous. The exceptional beauties of the place and the superb weather lent attractiveness to the occasion.

In the Geological Section, the following papers were offered, and, with few exceptions, read in full or in substance: Gravels of Glacier Bay, Alaska, with lantern illustrations, by H. F. Reid; Use of the Name "Catskill," by John J. Stevenson; Section across the Coastal Plain Region in Southern North Carolina, by J. A. Holmes; Notes on Further Observations of Temperature in the Deep Well at Wheeling, W. Va., by William Hallock; Recent Investigations in the Cretaceous Formation on Long Island, N. Y., by Arthur Hollick; Character of Folds in the Marquette Iron District, by C. R. Van Hise; The Fossil Sharks of Ohio, by E. W. Claypole; Hillsdale County Geology, by Horatio P. Parmelee; Exhibition of Trilobites, showing Antennæ and Legs, by Chas. D. Walcott; Remarks on the genus *arthrophycus* Hall, On the Value of Pseudoalgæ as Geological Guides, Studies in Problematic Organisms, and The Genus *Fucoides*, by Joseph F. James; Northward Extension of the Yellow Gravel in New Jersey, Staten Island, Long Island and Eastward, by Arthur Hollick; Some Questions Respecting Glacial Phenomena about Madison, by T. C. Chamberlin; Amount of Glacial Erosion in the Finger Lake Region of New York, by D. F. Lincoln; Ice-sheet on Newtonville Sandplain, by F. P. Gulliver; Additional Facts Bearing on the Question of the Unity of the Glacial Period, by G. Frederick Wright; Changes of Drainage in Rock River Basin in Illinois, by Frank Leverett; Graphic Comparison of post-Columbia and post-Lafayette Erosion, by W. J. McGee; An Illustration of the Effect of Stagnant Ice in Sussex Co., N. J., and A Phase of Superficial Drift, by R. D. Salisbury;

Tertiary and Quarternary Stream Erosion of North America, by Warren Upham; The Emergence of Springs, by T. C. Hopkins.

As the writer was unable to hear a considerable number of these papers his notes must be confined to comparatively few of them. The paper of Mr. Lincoln presented a very interesting sketch of the quite remarkable evidences of glacial erosion and modification of surface in the Finger Lake region of New York. He showed, successfully we think, that the existing topography could not have arisen in its present form through the agency of sub-aërial degradation alone nor by the simple deposit of drift material on a surface so produced, but that a very notable amount of reshaping of the rock-surface was the result of glacial abrasion.

Mr. Frank Leverett made a quite important contribution to the data bearing upon the stages and duration of the earlier glacial epoch. He has recently discovered evidence that the Rock River formerly flowed nearly due south from a point near Rockford into the Green River basin, and presumably onward to the great bend of the Illinois River, near Hennepin, where an old deep channel exists. From this course the river was diverted to its present south-westerly course by the earliest or at least one of the earlier stages of the ice invasion of that region. Between the time of this diversion and the stage at which the kettle moraine was formed across the Rock River about forty miles to the north, near Janesville, Wis., the river cut a trench in rock across a succession of preglacial cols to maximum depths estimated at 100 to 125 feet. Mr. Leverett made careful estimates of the total amount of rock excavation and found it to amount to one square mile 1100 feet deep. Stated in another form, this equals a trench 100 feet deep, one mile wide and eleven miles long, or one-half mile wide and twenty-two miles long. After the trench had been cut, the glacial wash from the outer edge of the kettle moraine partially filled the trench as shown by remnants of terraces still existing at different points along it. The amount of this filling within the area of the above computation is estimated as one square mile 900 feet thick or $\frac{9}{11}$ of the amount of rock excavation. Since the formation of these gravels the

stream has only partially removed this partial filling of the trench previously cut. The estimated amount of the material so removed since the time of the formation of the kettle moraine is one square mile 650 feet deep, or $\frac{1}{2}\frac{3}{4}$ as much as the *rock* excavation. From this it appeared that the amount of erosion in all post-glacial time (including the last of the glacial period), although wrought upon incoherent gravels, is much less than the amount of rock cutting accomplished between the time the river was diverted and the formation of the kettle moraine.

In the introduction to his paper Professor G. Frederick Wright stated that the hypothesis of an ice dam at Cincinnati appeared to be in a damaged condition, as an agency to account for the high terraces of the upper Ohio and some of its tributaries, and that it was a part of the purpose of the paper to repair the damage. It proved in the sequel, however, an effort at emendation by substitution. The additional facts bearing upon the unity of the glacial period cited in the paper related chiefly to a considerable depth of glacial wash in the trench of a tributary of the Beaver River near Homewood, Pa., just outside but near the border of the glaciated region. Professor Wright contended that the trough in which this glacial material lies must have been eroded previous to its deposition. This erosion he referred to pre-glacial times. The filling reaches nearly or quite to the upper terrace plain on the north side of the tributary, but does not appear on the terrace plain south of the tributary. In the course of his paper, and notably in the discussion following, Professor Wright advanced the hypothesis that the rock shelves which constitute the base of the high terraces of the upper Ohio, Allegheny and adjacent rivers, were formed during a stage of base-levelling in Tertiary times, that the narrower and deeper valley below the rock shelves (in round numbers 300 feet deep) was cut in this base-plane during a stage of elevation just preceding the glacial period, and that this trench was filled up with glacial wash and glacio-natant material to a height, at some points, as much as sixty feet above the rock shelves. In the discussion it was pointed out that, to

account for the fact that the trains of gravel that rise on the outer face of the adjacent moraines run down through this narrower deeper valley at low levels, it is necessary to suppose that there was an interruption of glacial action and a period of excavation during which the previously formed 300 feet or more of glacial wash was very largely carried away, and that this means a discontinuity of glacial action and an interglacial interval. The hypothesis is, therefore, not a contribution to unity but to discontinuity. The amount of excavation between the time of the supposed first filling of the trench and the partial refilling at the time of the formation of the adjacent terminal moraine was several times greater than all that has taken place since the moraine was formed. It signifies, therefore, a very notable interruption of continuity and a reversal of action. It may be here added that, logically, it also means the abandonment of the "fringe" theory to account for the older drift, for the filling of the valleys for so great distance and to so great depth means more than a trivial stage of advance, and the excavation previous to the formation of the moraine means more than a slight stage of recession.

Mr. Leverett has examined the Homewood locality since the meeting, and became satisfied that the partial filling of the trench at that point took place contemporaneously with a moraine which crossed the valley only a short distance above (some miles outside the glacial boundary as mapped by Lewis and Wright, and even some distance beyond the striæ not long since reported by Dr. Forshay, Mr. Leverett finding striation half a mile farther down the valley). The characteristics of this moraine seem to Mr. Leverett to indicate that it belongs to the group formed during the later incursion. The shelf of rock south of the tributary was not covered by the glacial wash of this stage because the trench lacked about twenty feet of being filled by the wash. Mr. Leverett found other remnants which he regards as parts of the same glacial flood-deposit farther down the Beaver, the surface rapidly descending as is the habit of such moraine-headed terraces near their sources. The facts

here, therefore, appear to be essentially the same as on other tributaries of the region which are crossed by the group of later moraines, and which seem to indicate profound excavation between the earlier and later drifts.

The hypothesis advanced in the paper, while not new in itself, having been among the multiple working hypotheses used by one or more students of the region, though not so far as known adopted by any one previously, is much more deserving of serious consideration than its predecessor, the Cincinnati ice dam. It may have some elements of truth in it, *i. e.*, a portion of the excavation of the rock below the old base-plane may have preceded the incursion of the glacial wash and even the glacial period. If this should prove true the effect will be to extend the importance of the earlier glacial epoch and to reduce the time necessarily attributed to the interglacial interval of excavation. The glacial formations of the lower Ohio and adjacent regions, however, seem to indicate a more complex hypothesis than this, or any previously advanced, which shall take cognizance of more than one glacial episode previous to the formation of the well-developed terminal moraines.

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ONE session of the Geological Section was adjourned to permit members to listen to papers read before the Anthropological Section having a geological bearing. These were the "Evidence of Glacial Man in America," by G. Frederick Wright; and "The Antiquity of Man in America," by W J McGee. The former consisted essentially of a restatement of the supposed evidences of the existence of man contemporaneously with the glacial period found in the terraces at Madisonville and Newcomerstown in Ohio, and at Trenton, N. J. The latter consisted essentially of a discussion of the character of evidence required for the establishment of the antiquity of man. Emphasis was especially laid upon the distinction between legal evidence and scientific evidence.

In the first paper no new discoveries were announced nor any additional data of note added to previous evidence. On

the other hand, the localities of Little Falls, Minn., Medora, Ind., and Loveland, Ohio, which have recently been urged as offering evidence of glacial man, were passed in silence. The paper referred constantly to the chipped stones as "paleolithic implements," and ignored the recent issue raised by Professor Holmes' investigations which are thought by many to make it probable that, whatever their geological age, the chipped stones are rejects and failures incident to the process of neolithic manufacture, and are therefore neither "paleolithic" nor "implements" in the proper sense of the terms. In the discussion, attention was called to the significant omission of three out of six of the localities which a year ago were urged as furnishing evidence of glacial man. Attention was called to the Ohio exhibit in the Anthropological Department of the Exposition in Chicago as furnishing proof that the testimony relating to the Newcomers-town locality cannot be accepted as having scientific value, because the point marked upon the photographs of the exhibit as being the location of the find cannot be rationally supposed to be the actual locality. Considerable discussion also turned upon the possibilities of intrusion, particularly through the agency of the growth and decay of the roots of successive generations of forests. It was urged that, allowing not more than six thousand years since the close of the glacial period, and allowing one hundred years for a generation of trees, sixty generations may have grown in succession. In the process of the growth of the large roots of the trees, the gravels and other material were pressed laterally and to some extent upward by their expansion, and on the decay of the roots the space they occupied was refilled, presumably from above, in part at least. In the case of trees which have tap roots the penetration is deep, particularly on gravel terraces where the substratum is porous and relatively dry and the ground-water far below the surface. It was urged that, in the refilling of the numerous tubes formed by the growth and decay of the roots of so many generations of trees, opportunities would be afforded for the occasional and sometimes deep penetration of relics that were originally

deposited at or near the surface. It was objected that the tubes formed by roots would be closed in by lateral creep and not from above. This, it may be here remarked, would depend upon whether the lower part of the root decayed before the upper part, or whether the decay proceeded from the surface downward. It would also depend upon whether the exterior of the roots rotted first or whether the bark resisted decay longest, leaving the interior, at a certain stage, practically hollow. It would appear that this subject has not received adequate attention, and that careful investigations respecting the growth and decay of roots in such situations should be made, and the possibilities of intrusion by means of them carefully determined. Reference was also made to the possibilities of intrusion through the agency of a similar succession of generations of burrowing animals. In view of the fact that in the paper under discussion only about twenty flaked stones of artificial origin were insisted upon as occurring deep within the gravels, the question of the possibilities of intrusion assumes very considerable importance. A certain amount of intrusion can fairly be claimed as probable. The vital question is, Can it be presumed to account for all cases not otherwise accounted for?

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THE admirable address of the retiring President of the American Association, Dr. LeConte, appears in this number of the JOURNAL and needs no comment. We hope to publish Vice-President Walcott's address in our next number.

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THE Woman's Section of the Geological Congress at Chicago, assembled on Monday, August 21, and held short sessions throughout the week. The following is the list of papers:

Methods of Teaching Geology, by Miss Mary Holmes, Ph.D., Rockford, Ill.; Physical Geology, by Miss Mary K. Andrews, Belfast, Ireland; Chemical Geology, by Miss Louise Foster, Boston, Mass.; Granites of Massachusetts and Their Origin, by Mrs. Ella F. Boyd, Hyde Park, Mass.; Artistic Geology, by

Mrs. S. Maxon-Cobb, Boulder, Colo.; The Geology of Ogle County, by Mrs. C. M. Winston, Chicago; The Fossils of the Upper Silurian, by Mrs. Ada D. Davidson, Oberlin, Ohio; Crinoidea and Blastoidea of the Kinderhook Group as found in the Quarries near Marshalltown, Iowa, by Jennie McGowen, A.M., M.D., Davenport, Iowa; The Evolution of the Brachiopoda, by Miss Agnes Crane, Brighton, England; The Mastodon in Northern Ohio; Post-Glacial or Pre-Glacial? by Miss Ellen Smith, Painesville, Ohio; Palæontology, by Miss Jane Donald, Carlisle, England; Glacial Markings, by Miss Thomson, Newcastle, England.

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THE general session of the Geological Congress convened at Chicago on August 24, immediately following the close of the meeting of the American Association at Madison.

The Congress was welcomed felicitously by the President of the Auxiliary, Charles C. Bonney, and briefly by the Chairman of the Committee on Organization.

Dr. A. R. C. Selwyn presided over the first session; Professor Joseph LeConte and Mr. Hjalmar Lundbohm, of Sweden, over the second session; and Professor James Hall and Dr. Groth, of Munich, over the third. The following papers were presented:

Pre-Cambrian Rocks of Wales, Dr. Henry Hicks, London, England; The Classification of the Rock Formations of Canada, with Special Reference to the Paleozoic Era, by Henry M. Ami, Geological Survey of Canada; The Cordilleran Mesozoic Revolution by Dr. A. C. Lawson, University of California; The Oil Shales of the Scottish Carboniferous System, by Henry M. Cadell, late of the Geological Survey of Scotland; Distribution of Pre-Cambrian Volcanic Rocks along the Eastern Border of the United States and Canada, by Professor George H. Williams, Johns Hopkins University; Huronian versus Algonkian, by Dr. A. R. C. Selwyn, Director Geological Survey of Canada; On the Migration of Material during the Metamorphism of Rock Masses, by Alfred Harker, St. John's College, Cambridge, Eng-

land; Wave-like Progress of an Epeirogenic Uplift, by Warren Upham, Geological Survey of Minnesota; Zur Nereiten Frage, by Dr. H. B. Geinitz, Dresden; Genetic Classification of Geology, by W J McGee, Bureau of Ethnology; The Extent and Lapse of Time Represented by Unconformities, by Professor C. R. Van Hise, U. S. Geological Survey; Restoration of Clidastes (illustrated), by Professor S. W. Williston, University of Kansas; Glacial Succession in the British Isles and Northern Europe, by Dr. James Geikie, Geological Survey of Scotland; Glacial Succession in Sweden, by Hjalmar Lundbohm, Geological Survey of Sweden; Glacial Succession in Switzerland, by Dr. Albrecht Heim, Zurich; Glacial Succession in Norway, by Dr. Andr M. Hansen, Geological Survey of Norway; The Succession of the Glacial Deposits of Canada, by Dr. Robert Bell, Canadian Geological Survey; Glacial Succession in the United States, by Dr. T. C. Chamberlin, University of Chicago; Pleistocene Climatic Changes, by Warren Upham, Geological Survey of Minnesota; Evidences of the Diversity of the Older Drift in North-western Illinois, by Frank Leverett, U. S. Geological Survey. A paper on the General Geology of Venezuela, by Dr. Adolph Ernst, was omitted on account of the illness of its author; and two papers by Dr. O. A. Derby, entitled, On the General Geology of Brazil, and On the Eruptive Phenomena of Brazil, were omitted because their author did not arrive until after the session. Four other papers announced were not read.

The latter part of the first session was devoted to a general discussion of the question, *Are there any Natural Geological Divisions of World-wide Extent?* The latter part of the second session was devoted to the question, *What are the Principles and Criteria to be observed in the Restoration of Ancient Geographic Outlines?* The general question assigned for the third discussion, *What are the Principles and Criteria to be observed in the Correlation of Glacial Formations in Opposite Hemispheres?* was omitted to give time for the discussion of the preceding glacial papers.

Several of the papers read will appear in this JOURNAL, and some of the matters touched upon in the discussions may be the

subjects of subsequent comment. About one hundred geologists were in attendance, a number which, under all the circumstances, was greater than was anticipated.

The afternoons of each day were devoted to the Exposition. Superintendent F. J. V. Skiff, Chief of the Department of Mines and Mining, and his associates, gave the members of the Congress a very pleasant welcome on their initial visit and provided special privileges of inspection that were heartily appreciated.

T. C. C.